

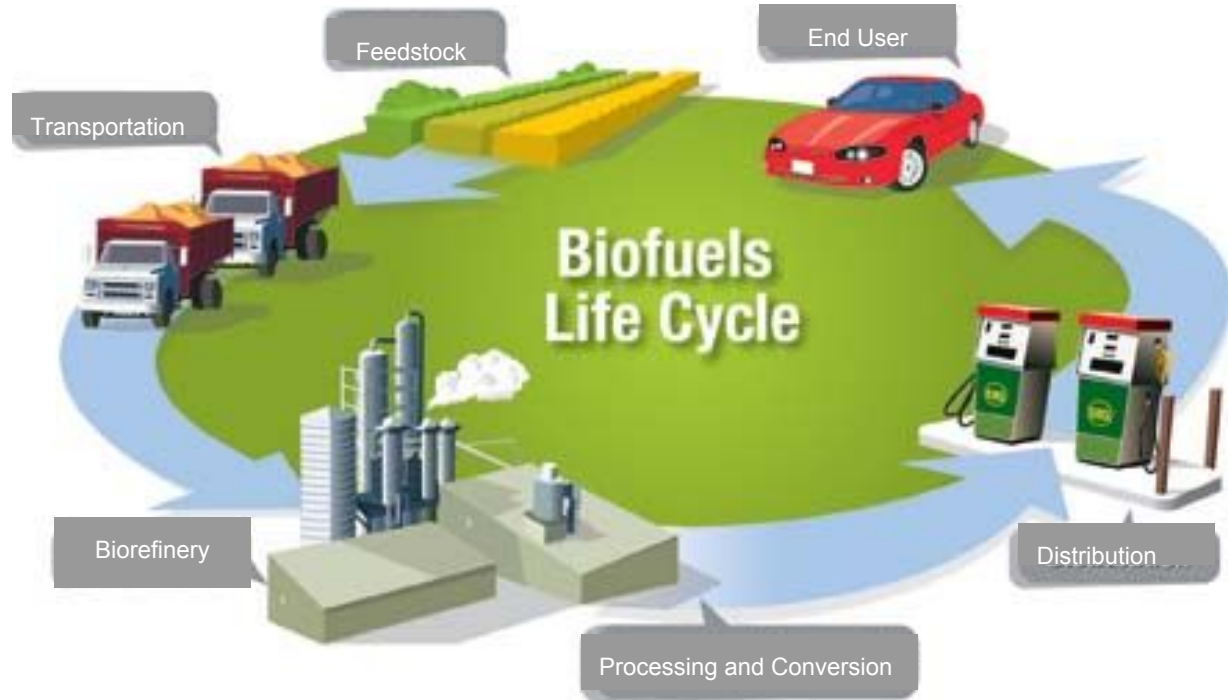


Lignin Degradation for the Production of Biofuels

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Biofuels



Types of Biofuels

**First
Generation**



**Second
Generation**



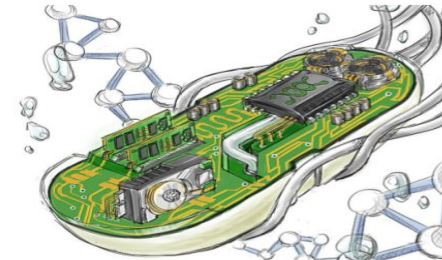
BIOFUELS



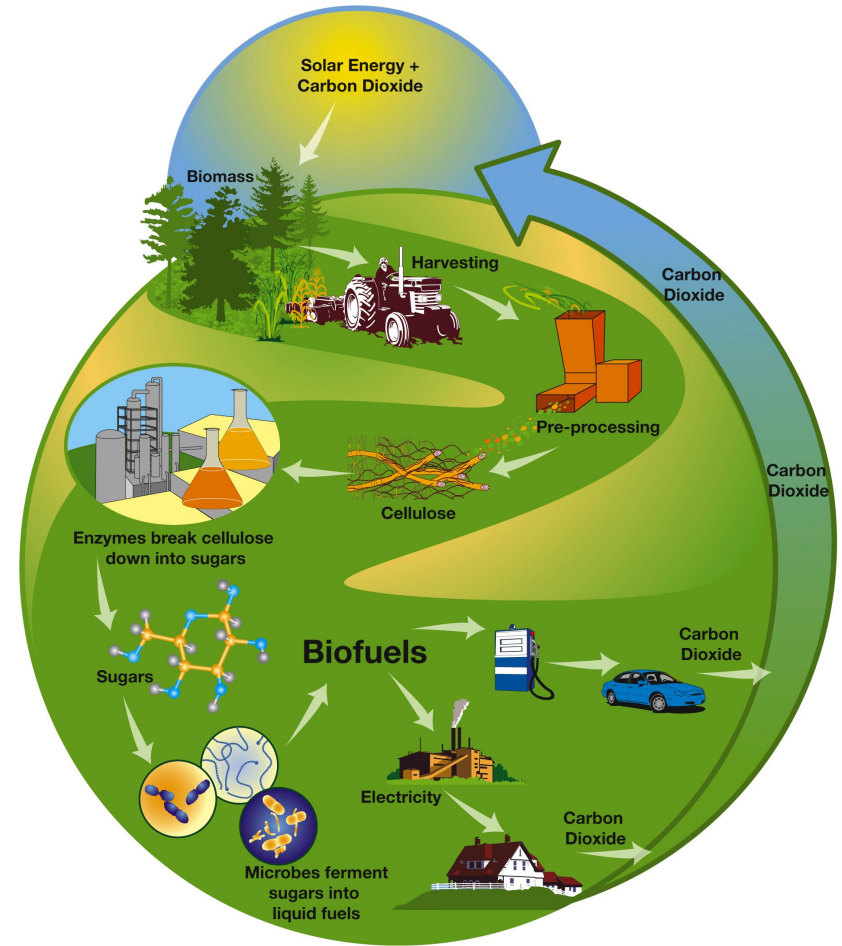
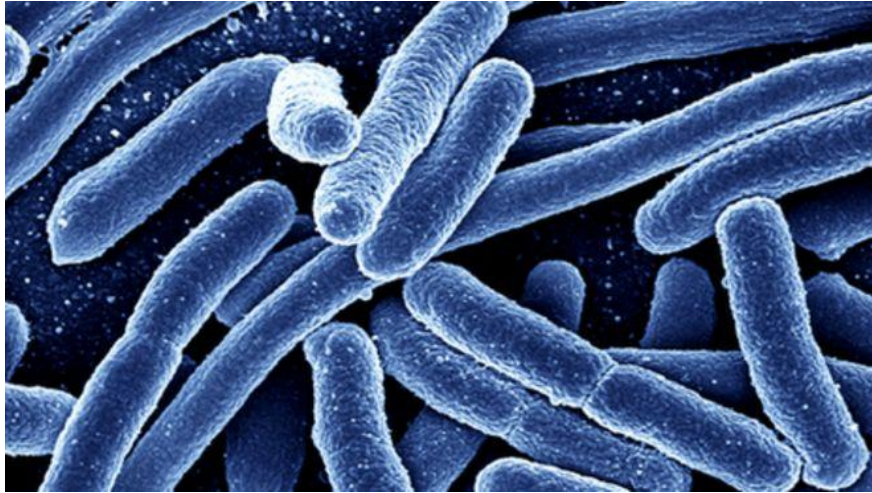
Third Generation



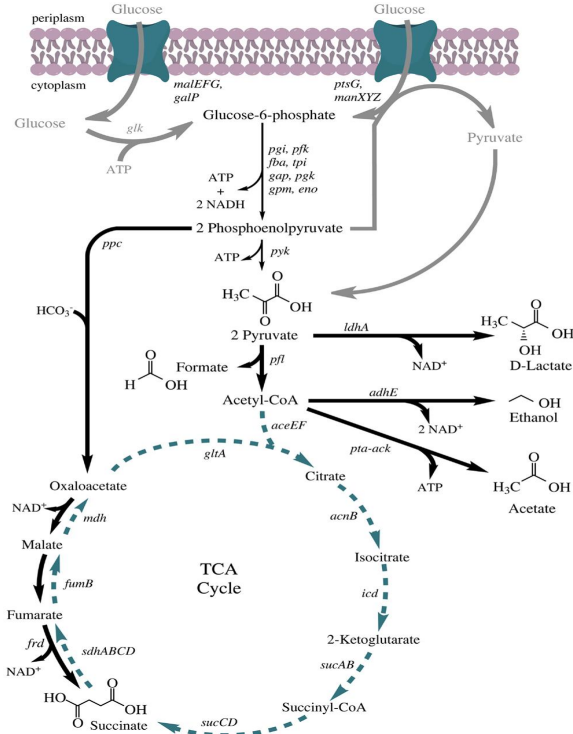
Fourth Generation



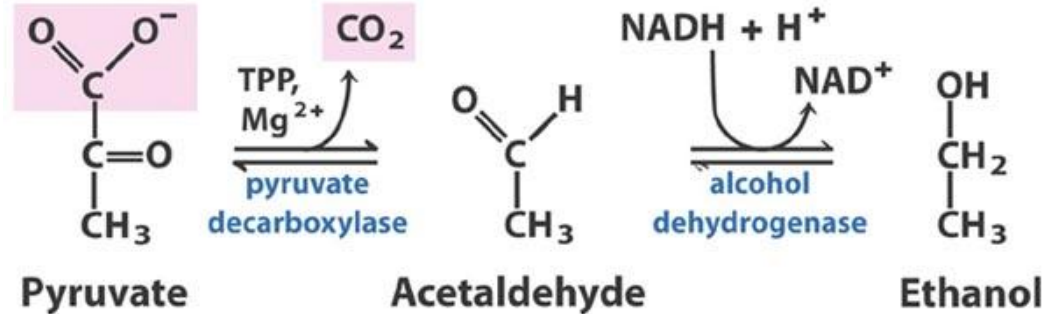
Biofuel from E.Coli



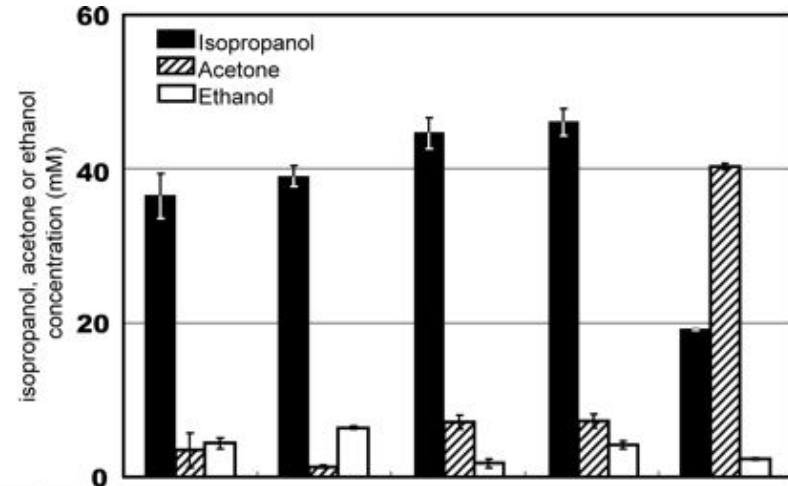
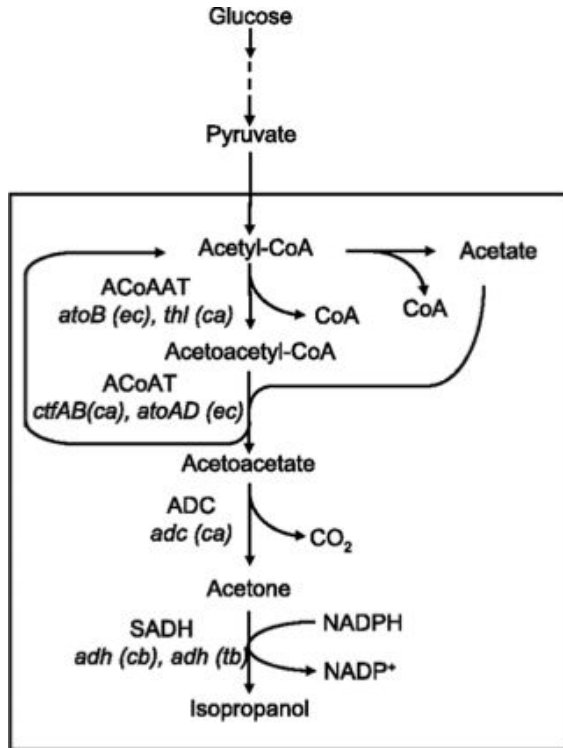
Ethanol from E.Coli



- Fermentation of glucose → Ethanol
- Inserting different genes to maximize ethanol production



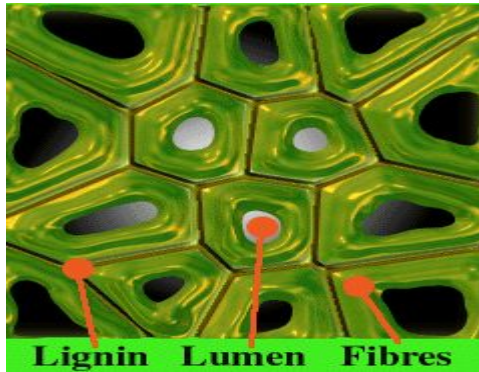
Higher Chain Alcohols (Butanol) from E.Coli



Enzyme	Gene name	plasmid				
		pTA41/pTA36	pTA29/pTA36	pTA30/pTA36	pTA39/pTA36	pTA39/pTA18
ACoAAT	<i>thl(ca)</i>	+			+	+
	<i>atoB(ec)</i>		+	+		
ACoAT	<i>ctfAB(ca)</i>	+	+			
	<i>atoAD(ec)</i>			+	+	+
ADC	<i>adc(ca)</i>	+	+	+	+	+
SADH	<i>adh(cb)</i>	+	+	+	+	
	<i>adh(tb)</i>					+

The Issue with Lignin

- Vital for plant growth, but difficult to break down
- Solutions for this problem include:
 - GMO plants
 - Use of lignin molecule



Switchgrass



Corn Stover

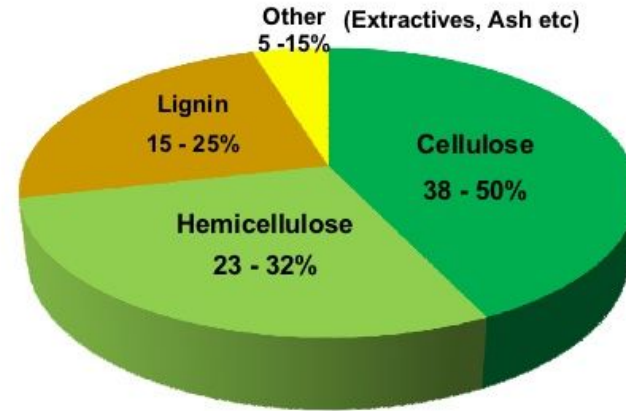


Bagasse



Wood chips

Lignocellulosic Biomass



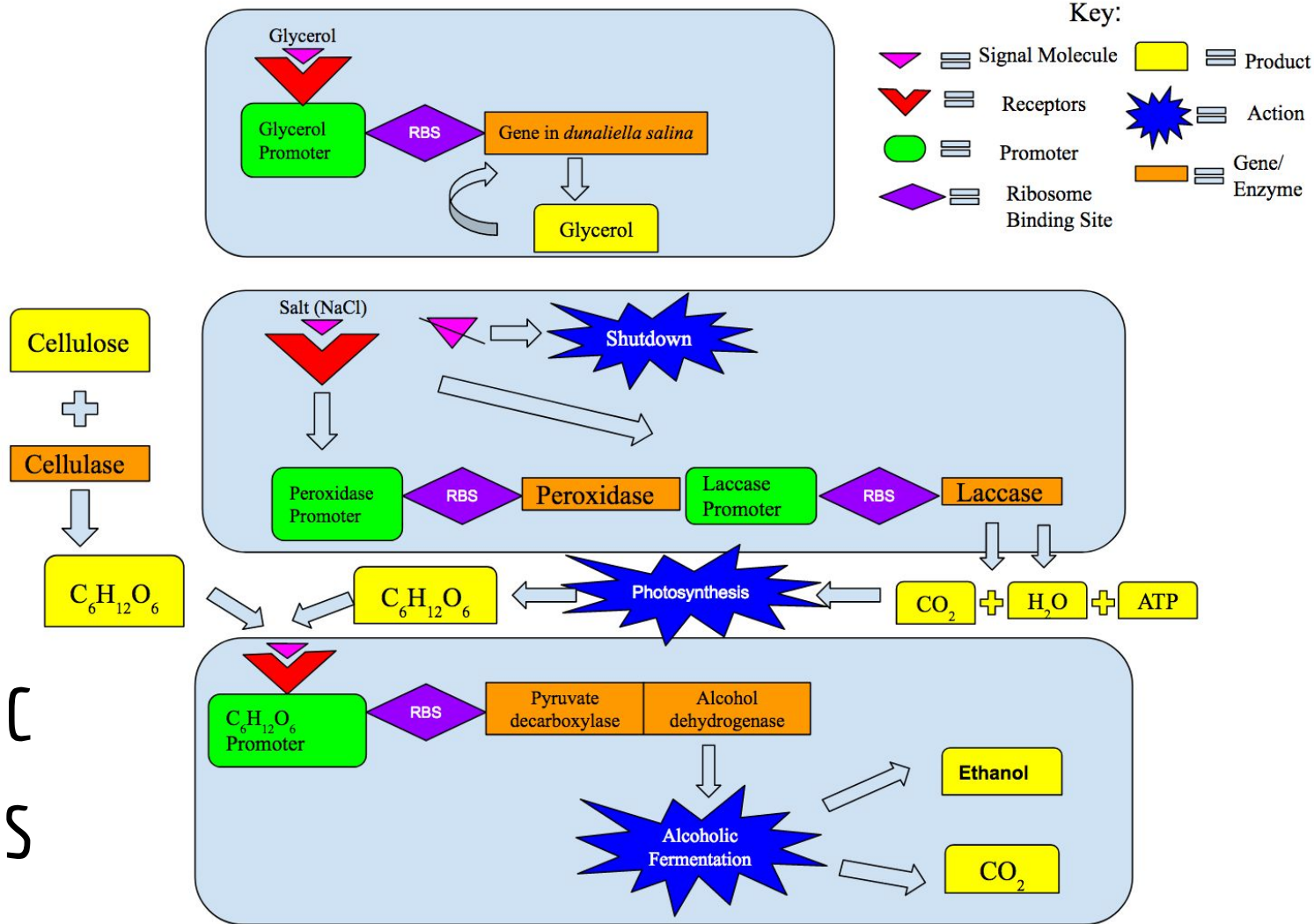
Our Solution



*Lignin-Degrading
Bacteria!*

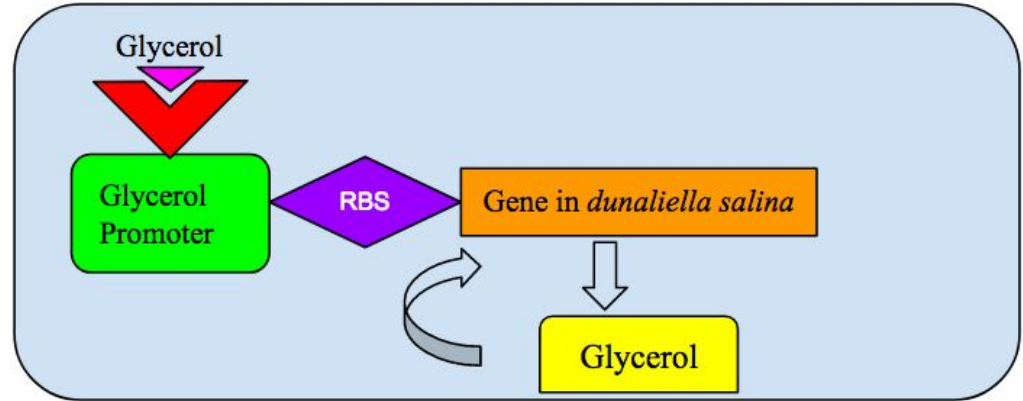


Metabolic Pathways



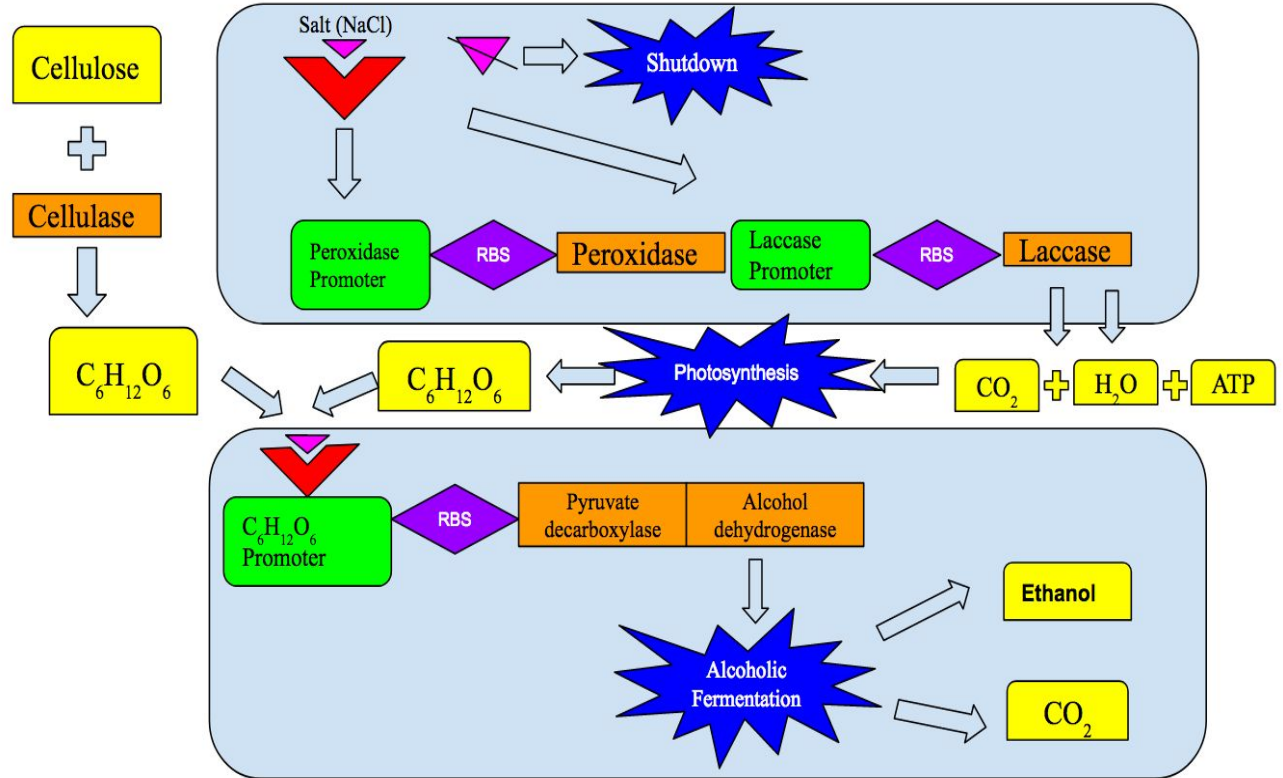
Pathway Part 1

- Gene in *dunaliella salina* produces high amounts of glycerol
- Withstands osmotic pressure
- Positive feedback of glycerol



Pathway Part 2

- Gene in white rot fungi produces enzymes that breakdown lignin
- Lignin and cellulose → sugar
- Fermentation occurs



Truth Tables of E.Coli

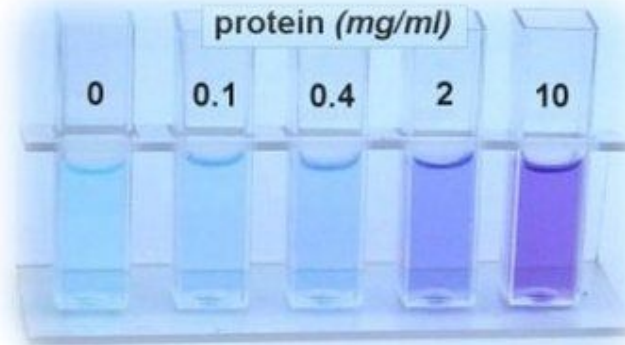
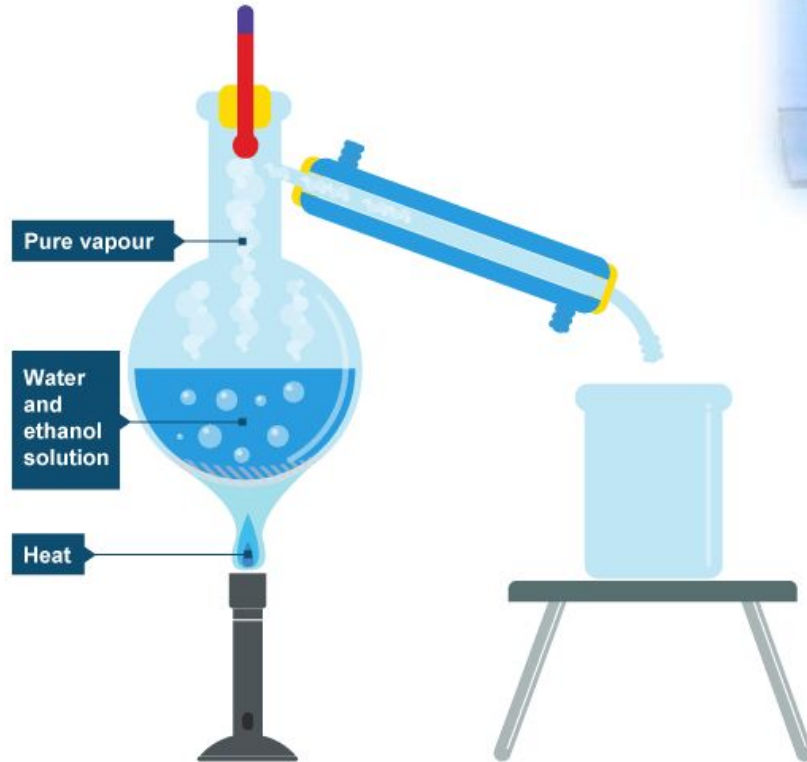
Salt	Peroxidase	Laccase
1	1	1
0	0	0

Salt	Bacteria Death
1	0
0	1

Set Amount of Glycerol	Glycerol Production
1	0
0	1

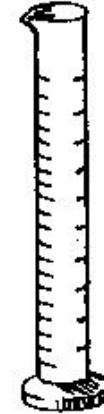
Glucose	Alcohol Dehydrogenase	Pyruvate Decarboxylase	Increased Ethanol
1	1	1	1
0	0	0	0

Testing of the Design



Biuret Test for
presence of
proteins

Distillation to
separate ethanol
and saline solution



Graduated
cylinder

Conclusion

- E. coli that break down plant parts into ethanol exist already
 - Not efficient, not enough yield
- Adding on genes that make bacteria break down lignin
- Bacteria also safer



Sources (Research)

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